MEASUREMENT OF MAGNHTOSTR1CTION BETWEEN 4.2 AND 77 K

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In recent years there has been considerable interest in applying the large strains associated with magnetostrict ive rare earths to low temperat ure actuator applications such as liquid helium valves, which operate at or below 4,2 K, and micropositioning devices for IR satellite optics, which operate in the 20 - 30 K range. New instrumentation is needed to explore the low temperature behavior of these materials. We have developed a continuous cooling cryogenic dilatometer that can facilitate the rapid turnaround of a large number of samples. The magnetostriction, determined with 8 nm resolution, and magnetization data are collected simultaneously. The new high temperature super conducting (} ITSC) coil, provided by American Superconductor, Inc., equipped with a resistance heating element, allows the magnetostriction and magnetization to be determined in the temperature range from 4 to 77 K. For measurements in the range from 77 K to room temperature, a copper coil replaces the 1 ITSC coil. Loads of up to 750 N and fields as high as 3.0 kOe can be applied to the specimen. This facility has been used to measure the magnetic properties of several low temperature rare earth magnets. A $Tb_{.5}Dy_{.5}Zn$ single crystal shows magnetostrictive strain of 0.46% at 9 K for an applied field of 2.9 kOe, which compares well with previously reported values. Polycrystalline $Tb_{.76}Dy_{.24}$, rolled to induce texture, is shown to exhibit magnetostrictive strains which are a significant fraction of those obtained for single crystals.